

# AIR TRANSPORTATION IS CRITICAL TO THE U.S. ECONOMY.



#### Why is aviation so important?

The air transportation system is critical to U.S. economic vitality.

## \$1.3 TRILLION TOTAL U.S. ECONOMIC ACTIVITY

(Civil and general aviation, 2009)

\$47.2 BILLION
POSITIVE TRADE BALANCE



## 10.2 IVILLION DIRECT AND INDIRECT JOBS

DINDIRECT JOBS (Civil and general aviation, 2009)

5.2 PERCENT OF TOTAL U.S. GROSS DOMESTIC PRODUCT

(Civil and general aviation, 2009)



#### Why should I care?

Aviation drives many different parts of the economy.



(Exports, domestic, indirect spending, 2008)

\$636 BILLION SPENT BY AIR TRAVELERS IN U.S. ECONOMY



(Foreign and domestic travelers, 2008)

734 VILLION AT PASSENGERS ON U.S. CARRIERS

(Domestic and international, 2012)









YOU **MAY NOT HAVE** 

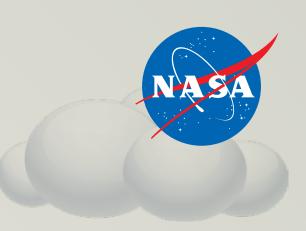
FLOWN TODAY,



DID.







#### What are the challenges?

Innovation improves efficiency, but challenges remain.

28% RISE IN COST FROM 2010 TO 2011

# JET FUEL

16.4 BILLION GALLONS BURNED IN 2011

(U.S. airlines, +3% in 2012)





\$9.3 BILLION SPENT ON

# NOISE ABATENT

**BY AIRPORTS SINCE 1982** 





#### Where do we see NASA's benefits today?

NASA's fundamental research can be traced to ongoing innovation.

#### NASA'S WORK ON THESE TECHNOLOGIES

- Advanced composite structures
- Chevrons
- Laminar flow aerodynamics
- Advanced computational fluid dynamics (CFD) and numeric simulation tools

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- Advanced ice protection system

#### WAS TRANSFERRED FOR USE HERE

Boeing **747-8** 

AIRCRAFT

**787** 

#### TODAY'S BENEFITS



more fuel-efficient/reduced CO<sub>2</sub> emissions



30%
lower NO<sub>x</sub> emissions

noise reduction compared to 747-400

20%

more fuel-efficient/reduced CO, emissions





smaller noise footprint





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#### NASA'S WORK ON THESE TECHNOLOGIES

- Compression system aerodynamic performance advances
- Low-NO<sub>x</sub> TAPS II combustor
- Low-pressure turbine blade materials
- High-pressure turbine shroud material
- Nickel-aluminide bond coat for the high-pressure turbine thermal barrier coating

- Low-NO<sub>x</sub> Talon combustor
- Fan aerodynamic and acoustic measurements
- Low-noise, high-efficiency fan design
- Ultra-high-bypass technology
- Acoustics modeling and simulation tools

#### WAS TRANSFERRED FOR USE HERE

CFM **LEAP-1B** 

JET C ENGINES

Pratt & Whitney
PUREPOWER 1000G
GEARED TURBOFAN

#### **TODAY'S BENEFITS**



reduction in fuel burn/reduced CO, emissions

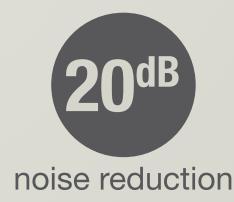


15<sup>dB</sup> noise reduction

16%

reduction in fuel burn/reduced CO, emissions







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EFFICIENT DESCENT ADVISOR

SYNTHETIC/ENHANCED VISION SYSTEMS

DATA-MINING ALGORITHMS



#### WERE TRANSFERRED FOR USE HERE

## FEDERAL AVIATION ADMINISTRATION (FAA)

Phased deployment by the FAA will start by 2014; full deployment will be in place by 2020.

#### AVIONICS MANUFACTURERS

(Honeywell, Rockwell Collins, GE Aviation)

There are more than 1,000 enhanced vision systems and more than 3,000 synthetic vision systems flying today.

### FEDERAL AVIATION ADMINISTRATION AND AIRLINES

The FAA's Aviation Safety
Information and Analysis Sharing
system uses NASA algorithms,
in common with airline partners like
Southwest Airlines.

#### **TODAY'S BENEFITS**

- Fuel-efficient continuous descents
- Potential \$300 million jet fuel savings per year (savings vary per spot fuel costs)
- Reduced delays in congested airspace
- Reduced noise and emissions around airports
- Retained safety
- Reduced controller workload through increased automation

- Improved ability to "see" in poor conditions
- Improved ground hazard avoidance
- Useful for civilian, military, and robotic flight
- Reduced landing ceiling and threshold minimums
- Safe, intuitive training environment for newer pilots

- Improved discovery by individual airlines of relevant operational events
- Increased identification of safetyrelated incidents
- Increased sharing of safetyrelated trends across airlines
- Reduced rate of incidents systemwide





## Did you know that NASA is with you when you fly?



TRAFFIC CONTROL TOWNER

HAS NASA-SUPPORTED TECHNOLOGY ON BOARD.